

Appl. No. 10/783,495
Amdt. dated 02/10/2009
Response to Office action of 10/16/2008

Attorney Docket No.: N1085-00251
[TSMC2003-0834]

REMARKS/ARGUMENTS

Claims 1-2 and 3-22 were previously pending in this application and each was rejected. Claims 1, 4, 5 and 8 are amended herein.

Applicants respectfully request re-examination, reconsideration and allowance of each of pending claims 1 and 3-22.

I. Claim Rejections - 35 U.S.C. § 103

In paragraph 3 of the subject Office action, claims 1, 3, 4 and 9-11 were rejected under 35 U.S.C. § 103(a) as being anticipated by Park, U.S. Patent No. 6,825,912 in view of U.S. Patent No. 6,630,362 to Lensing, hereinafter "Lensing". Applicants respectfully submit that these claim rejections are overcome for reasons set forth below.

Claim 1 is an independent claim among the claims rejected in this section. Independent claim 1 recites the features of:

controlling the exposure energy with a feed forward process control signal of a compensation amount that compensates for thickness variations in a subjacent layer beneath a top layer, by combining the feed forward process control signal with the feedback process control signal to control the exposure energy used in patterning the top layer.

The top layer is clearly distinguished from the subjacent layer: a subjacent layer beneath a top layer. Claim 1 clearly recites that it is the thickness variations in one layer, i.e., the subjacent layer, that is used for controlling the exposure energy used in patterning another layer, i.e., the top layer.

In the subject Office action, the Examiner indicates that Park teaches "a feed forward process control signal . . . of a compensation amount that compensates for wafer thickness variations," then relies upon Lensing and alleges that "Lensing teaches to controlling the exposure energy in semiconductor manufacturing."

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Applicants respectfully submit that Park does not teach the claimed feature of using a thickness variation in a first layer to control the exposure energy used in patterning a *different* layer. Park, in contrast, is limited to using the thickness measurement of the same layer being patterned. Col. 4, ll. 35-37 of Park provide:

5 In this invention, a reflectivity is determined by the thickness and quality of substrate surface formed in the most recent pre-exposure step process.

Col. 4, ll. 59-64 continue:

10 During processing, a wafer is first provided to a pre-exposure step process. In the pre-exposure step process 10, a silicon-nitride film is preferably deposited uniformly on the surface of a wafer. Next, the wafer is provided to a photo-exposure process 20. In the photo-exposure process 20, a photoresist is formed over a whole surface of the wafer

15 FIG. 1 clearly shows that there are no interceding steps between pre-exposure step process 10 and photo-exposure process 20. Moreover, at no point does Park teach using the SiN thickness in a feed forward signal to the photo-exposure unit to control the photo-exposure process of another film. As such, Park is limited to using a thickness or reflectivity measurement of a film to provide a feed forward signal used in patterning that same film, not another film formed over the measured film as in claim 1. Claim 1 is therefore distinguished from Park.

20 Applicants also submit, at this time, that independent claim 12 is similarly distinguished from Park. Independent claim 12, see infra, also provides for a feed forward signal of thickness of one layer used to control the exposure of a different layer:

25 a feed forward controller providing a feed forward control signal to an exposure apparatus based on a thickness measurement of an interlayer of the first patterned wafer substrate for controlling the exposure energy focused on a top layer of the first patterned wafer substrate, and . . .

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As such, independent claim 12 is similarly distinguished from Park.

The Examiner acknowledges that "*Park does not expressly teach to exposure energy (per definition of exposure energy on pg. 1, par [0002] of Applicant's Specification).*" The Office action then alleges that Lensing teaches to controlling the exposure energy in semiconductor manufacturing and that "it would have been obvious to a person of ordinary skill in the art . . . to modify the teaching of Park to include controlling the exposure energy."

Applicants respectfully disagree and point out that the Park reference is titled SYSTEM FOR ADJUSTING A PHOTO-EXPOSURE TIME. The entire Park disclosure is directed to adjusting exposure time. The word "energy" does not appear in the Park patent. Lensing is apparently relied upon for proposing an increased energy exposure as an alternative to a longer duration exposure, but one of ordinary skill would not modify the Park teaching based on this suggestion in Lensing because doing so would preclude the Park invention from carrying out its intended purpose. Park therefore teaches away from the proposed modification. Park is directed to adjusting exposure time and only exposure time. The claims in Park are not directed to changing any other parameter of the exposure process and the claims are not broadly directed to improving the quality of a photolithography process, but rather, the claims, e.g., claim 1, are directed to: a system for adjusting a photo-exposure time in a semiconductor manufacturing apparatus. The purpose of Park is to change exposure time and apparently, nothing else. The entire disclosure is directed to changing the photo-exposure time. One of ordinary skill in the art and in possession of a reference so directed and titled "System for Adjusting a Photo-Exposure Time", would not modify the reference to adjust something other than a photo exposure time, i.e., one would not modify such a reference to adjust exposure energy.

Even if one did attempt to combine the teachings of Park and Lensing, Lensing still does not make up for the above-stated deficiencies of Park rendering claims 1 and 12 distinguished from Park in view of Lensing.

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Claims 3, 4 and 9-11 each depend from claim 1 and are similarly distinguished from the combination of Park and Lensing. The rejection of claims 1, 3, 4 and 9-11 under 35 U.S.C. § 103(a), should be withdrawn.

II. Claim Rejections – 35 U.S.C. § 103 – Claims 5-8 and 12-22

5 In paragraph 10 of the subject Office action, claims 5-8 and 12-22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Park in view of Lensing in further view of U.S. Patent No. 6,798,529 to Saka, et al. (hereinafter "Saka"). Applicants respectfully submit that these claim rejections are overcome for reasons set forth below.

10 Claims 5-8 depend from claim 1, which is distinguished from Park and Lensing, as above. Claim 12 is an independent claim with claims 13-22 depending from claim 12. Claim 12 is also distinguished from Park and Lensing as above.

15 Saka has apparently been relied upon for an interlayer thickness measurement after chemical mechanical planarization. This does not make up for the above-stated deficiencies of Park in view of Lensing. Saka is not directed to controlling exposure energy. Saka, in fact, is not even directed to controlling the exposure process in any manner. Saka is directed to detecting endpoint in chemical mechanical polishing (CMP). In Saka, the control signals based on thickness measurements are only used to control the CMP apparatus and Saka monitors the thickness and reflectance of the layer being polished, i.e., removed, not a subjacent layer or another layer different than the
20 one being processed, as in the claimed invention.

Because Saka does not make up for the above-stated deficiencies of Park in view of Lensing, independent claims 1 and 12 and therefore also dependent claims 5-8 and 13-22, are distinguished from Park in view of Lensing and Saka. The rejection of claims 5-8 and 13-22 under 35 U.S.C. § 103(a) as being unpatentable over Park in view
25 of Lensing and Saka, should be withdrawn.

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CONCLUSION

Based on the foregoing, each of pending claims 1 and 3-22 is in allowable form and the application in condition for allowance, which action is respectfully and expeditiously requested.

5 The Assistant Commissioner for Patents is hereby authorized to charge any fees necessary to give effect to this filing and to credit any excess payment that may be associated with this communication, to Deposit Account 04-1679.

Respectfully submitted,

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Mark J. Marcelli, Reg. No. 36,593
Attorney for Applicant

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20 DUANE MORRIS LLP
101 West Broadway, Suite 900
San Diego, CA 92101
Telephone: (619) 744-2200.
Facsimile: (619) 744-2201